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ROOT-KNOT DISEASE IN FLORIDA SOYBEAN

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Introduction: The cropping of soybean (Glycine max (L.) Merr.) in Florida has varied (100,000 - 190,000 hectares) with market price trends over the last few years. Seeds are sown in May-June, usually following winter cereal or fallowed stubble, and harvested in October-November. The crop is essentially confined to the northern tier of counties through the Panhandle east to the north-central region of the state. The bulk of the crop is grown west of the Apalachicola River and is the predominant field crop in that region.

A major limiting factor of soybean production is root-knot disease which is endemic to the area and is incited by one or more of three species of nematode. Meloidogyne javanica (Treub) Chitwood is the least ubiquitous; its distribution, mainly in the north-central counties, is generally associated with the production of tobacco to which this nematode is highly infectious (7). Meloidogyne arenaria (Neal) Chitwood can be found in many localities throughout the soybean production area. Its distribution and importance are increasing annually (2). Meloidogyne incognita (Kofoid and White) Chitwood is the predominant species associated with root-knot disease of soybean and can be expected wherever the crop is grown in the State (8).

Epidemiology: Soil temperatures during the soybean season are sufficiently high to stimulate egg hatching and root infection by the vermiform second stage juveniles of the nematode. Their density in the soil normally reaches its peak at the time of soybean maturity, when as many as 500 per 10 cc soil have been found. Following harvest, there is a period of declining soil temperatures that reduces the activity of the juveniles. Consequently, there is a period from December through early February when the densities of root-knot juveniles in the soil remain quite static. Rising soil temperatures in the spring are accompanied by a rapid reduction in numbers of juveniles (3). This may be due to a number of factors including increased activity of the nematode and the depletion of its food reserves. Also contributing to the decline could be a general increase in the activity of members of the soil arthropod and microbial community whose predatory and parasitic habits are detrimental to the survival of the nematode. At soybean planting the soil density of juveniles is at its lowest, usually less than 10% of the previous postharvest density.

Juveniles penetrate the roots of the developing soybean and, through a series of moults, become adults, the great majority of which are swollen females. Reproduction is by parthenogenesis with each female producing up to several hundred eggs. Several overlapping generations of 3-4 weeks duration are completed through the season.

SYMPTOMS: Indications of unthriftiness due to root-knot disease may appear as early as July if the crop is heavily infected and has been subjected to some drought stress. Infected areas of the crop become progressively more stunted and wilt more readily in the heat of the day. Swollen areas of the roots (galls), a response to the infection by the nematode, are visible by this time and can be readily distinguished from rhizobial nodules. The galls are a primary symptom for identifying the disease. As the season progresses, infected plants will evidence chlorosis to varying degrees (Fig. 1). By late August plant roots can be severely galled (Fig. 2) and plants may succumb if sufficient water has not been available for them to overcome the stress. Even in moderately infested sites plants will mature one to two weeks earlier than normal.

Management: Currently there are no cost-effective nematicides for reducing root-knot disease in soybean. Its management consists of rotating soybean with less susceptible hosts of the root-knot species combined with the selection of the proper resistant soybean cultivar (4). Consequently, the first step in good management is the identification of the root-knot species and knowledge of their field distribution and soil infestation levels. This is accomplished by sampling infected roots towards the end of the soybean season and a thorough soil sampling immediately following harvest. If soil infestation levels at this time are high, growers are advised to decrease the population levels by summer fallowing or by planting a non-host or other less susceptible host than soybean the following summer season, irrespective of the species of root-knot nematode identified. A few soybean cultivars have a reduced susceptibility to M. javanica and M. arenaria. However, they should only be grown in rotation following summer fallow or a non-host crop in soil known to be infested by these nematodes.

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Although there are several soybean cultivars that have been bred to withstand infestations of M. incognita (6), their resistance is quantitative in nature and they can experience sufficient yield loss to make production less than profitable if populations of this nematode are initially high. They may be produced profitably if previous post harvest densities of M. incognita are low to moderate (40 per 10 cc soil) (5). Frequent summer production of crops other than soybean is advisable to maintain a low incidence of soil-borne diseases, to which soybean may be susceptible, in addition to root-knot disease.

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Fig. 1. Top growth of a susceptible cultivar, H8112 (left), and a resistant cultivar, Kirby (right), growing in soil densely infested with Meloidogyne incognita.

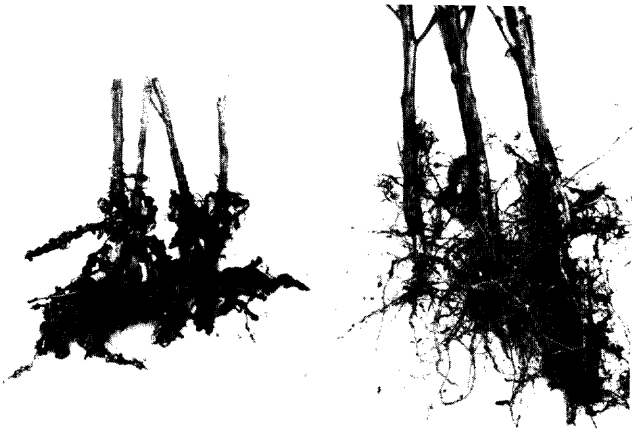

Fig. 2. Root growth of H8112 (left), showing severe root-knot galling, and Kirby (right) with comparatively less galling. Samples were taken from adjacent rows in a field whose soil was densely infested with Meloidogyne incognita.

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